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14. ABSTRACT

Global warming and the associated melting of sea ice are altering the character of the Arctic environment. The changing Arctic is important to the United States due to the potential for economic gain, improved energy security, increased human activity and national security. A framework to address the changing Arctic within the U.S. government and military exists, but is not mature. This paper performed an analysis of preparations by the U.S. government and military to date for operations in an ice-free Arctic. The analysis found that the approach employed by the U.S. military consists of three tiers; promulgating strategic guidance, identification of missions and capability gaps, and gleaning lessons learned from exercises and war gaming. This approach has yielded benefits but is deficient at the operational level and has not sufficiently articulated the sustainment requirements for operations in an ice-free Arctic environment. This paper also conducted an analysis of U.S. military preparations for an ice-free Arctic using the tenets of operational art. An analysis of the operational factors of time, space and force with regard to the missions in the Arctic and as it applies to the operational function of logistics can help improve the U.S. military's assessment of sustainment requirements. By supplementing the three tiered approach with an analysis using operational art, the U.S. military can improve upon its assessment of sustainment requirements in the Arctic than had it used the three tiered approach only.

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DETERMINATION OF SUSTAINMENT REQUIREMENTS FOR OPERATIONS BY THE U.S. MILITARY IN AN ICE-FREE ARCTIC USING THE TENETS OF OPERATIONAL ART

by

Jeffrey S. Dixon

LCDR / USN

A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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Paper Abstract

Determination of Sustainment Requirements for Operations by the U.S. Military in an Ice-free Arctic Using the Tenets of Operational Art

Global warming and the associated melting of sea ice are altering the character of the Arctic environment. The changing Arctic is important to the United States due to the potential for economic gain, improved energy security, increased human activity and national security. A framework to address the changing Arctic within the U.S. government and military exists, but is not mature. This paper performed an analysis of preparations by the U.S. government and military to date for operations in an ice-free Arctic. The analysis found that the approach employed by the U.S. military consists of three tiers; promulgating strategic guidance, identification of missions and capability gaps, and gleaning lessons learned from exercises and war gaming. This approach has yielded benefits but is deficient at the operational level and has not sufficiently articulated the sustainment requirements for operations in an ice-free Arctic environment. This paper also conducted an analysis of U.S. military preparations for an ice-free Arctic using the tenets of operational art. An analysis of the operational factors of time, space and force with regard to the missions in the Arctic and as it applies to the operational function of logistics can help improve the U.S. military's assessment of sustainment requirements. By supplementing the three tiered approach with an analysis using operational art, the U.S. military can improve upon its assessment of sustainment requirements in the Arctic than had it used the three tiered approach only.

INTRODUCTION

The United States government and its military support and protect the interests of its people and those of its allies around the world. However, the U.S. military has historically limited operations in the polar latitudes due to the extreme environmental conditions. Historically, natural resources within the Arctic have not been harvested. Also, commercial activity has been constrained while potential adversaries have not maintained a robust presence for similar reasons. However, the environment is changing. The trend of global warming and the associated melting of sea ice in the Arctic is a reality that is altering the character of this environment.

The trend of global temperature increases is not going to be significantly reversed in coming decades and, therefore, ice melting patterns being observed in the Arctic will continue. The historically low tempo of operations by the U.S. military in the Arctic has resulted in modest capabilities and resources to support operations in the extreme polar latitudes. The U.S government and members of the international community, with indispensible support from the scientific community, have recognized the changing Arctic and the associated implications of this environmental change. Elements of a framework to address the changing Arctic within the U.S. government and military exist at different levels, but the overall plan is not mature. A primary shortcoming pertains to the sustainment of forces that will operate in the arctic environment. Operational logistics is one of the most important operational functions and vital to success of military operations. Development of a robust sustainment plan at the outset will be vital to success of military operations in the Arctic environment.

The approach that the U.S. military has employed to prepare for an ice-free Arctic has consisted of three tiers; promulgating strategic guidance, identification of missions and capability gaps, and gleaning lessons learned from exercises and war gaming. However, this approach has not sufficiently articulated the sustainment requirements necessary to best address operations in an ice-free Arctic environment. By applying tenets of operational art, specifically analyzing the factors of time, space and force against operational objectives as these tenets apply to the operational function of logistics the U.S. military can improve upon its assessment of sustainment requirements in the Arctic for the coming decades. The intention of this paper is to perform an analysis of U.S. military preparations for ice-free Arctic using tenets of operational art, specifically the factors of time, space and force with regard to the operational function of logistics. The goal of this is to assess whether a sufficient sustainment plan has been outlined and if not, provide recommendations that can benefit the U.S. military's preparation for an ice-free Arctic.

POTENTIAL COUNTER-ARGUMENT

Some would argue that an effort to develop a sustainment plan to support military operations in the Arctic is not prudent due to the austere fiscal environment and the perception that an ice-free Arctic is far into the future. Robust logistical support is likely to require forward logistics bases and possibly ship construction which would require capital investment. It is difficult to garner support for capital investment into Arctic forces considering the burgeoning federal deficit and the expectation that an ice-free Arctic will not be a reality for many decades. In fact, the Department of Defense (DOD) stated in a May 2011 report to congress "[g]iven the many competing demands on [the defense] department's resources in the current fiscal environment the Department believes that further evaluation of

the future operating environment is required before entertaining significant investments in infrastructure or capabilities."[1]

The conclusion stated by the DOD is reasonable. Budget challenges in the near future are a reality that will dominate discussions regarding any government investment in Arctic infrastructure. Additionally, further evaluation is necessary. More accurate evaluation of the changing Arctic environment, determination of the forces needed and their sustainment requirements can only be achieved through continued study of these issues. Elements of the U.S. government continue to do exactly this. For example, the DOD and Department of Homeland Security (DHS) held the Arctic Capability Development Workshop in March of 2012 to identify shared capability gaps and near-term investment recommendations.[2]

Government and military planners face uncertainty regarding the precise timeline when the Arctic will be ice-free. Although estimates for when the Arctic will experience ice-free conditions range from 2013 to 2060, the consensus of most models and researchers is the Arctic will experience ice-free conditions for a portion of the summer by 2030.[3] Such a timeline can be interpreted by some as long term and, when combined with the current budget challenges, provide easy rationalization to defer decisions on infrastructure or capital investment. However, the extended timelines common in government procurement or DOD acquisitions indicate that a 2030 time horizon requires decisions today. "Development of

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[1] U.S. Department of Defense, *Report to Congress on Arctic Operations and the Northwest Passage,* Washington, DC: Department of Defense, May 2011, 3-4.

[2] U.S. Department of Defense and Department of Homeland Security, *Arctic Capabilities Assessment Working Group (CAWG) White Paper,* Washington, DC: Department of Defense and Department of Homeland Security, March 2012, 1.

[3] *Navy Arctic Talking Points*, 2009, Quoted in Rear Admiral David W. Titley, U.S. Navy, and Courtney C. St. John, "Arctic Security Considerations and the U.S. Navy's Roadmap for the Arctic," *Naval War College Review* 63 no. 2 (Spring 2010): 36.

Arctic operations support infrastructure requires long lead times…The extensive programming timelines required for construction funding make early requirements identification critical."[4] Therefore, the constrained budget combined with the incorrect assessment that an ice-free Arctic is far enough in the future to justify inaction on capital investment today is an imprudent assertion.

DISCUSSION

Scientific Substantiation

A solid body of scientific evidence substantiates the existence of global warming and illustrates the cogent issue of Arctic sea ice melt. The NASA Goddard Institute for Space Studies surface temperature analysis has measured changing global surface temperature since 1880 when a reliable global distribution of meteorological stations was established. Their most recent summary of data indicates global surface temperatures in 2011 were the ninth warmest since 1880 and 0.51°C above the 1951-1980 average. This continues a trend in which nine of the 10 warmest years have occurred since the year 2000.[5] Relative to the 1970s, the earth's temperature has increased sufficiently to cause significant melting of glaciers and Arctic sea ice.[6] The National Snow and Ice Data Center started using satellites

[4] U.S. Department of Defense and Department of Homeland Security, *Arctic Capabilities Assessment Working Group White Paper*, 9.

[5] J.E. Hansen, R. Ruedy, M. Sato, and K. Lo. 2012. NASA GISS Surface Temperature (GISTEMP) Analysis, In *Trends: A Compendium of Data on Global Change*. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., U.S.A. doi: 10.3334/CDIAC/cli.001 http://cdiac.ornl.gov/trends/temp/hansen/hansen.html (accessed 8 March 2012).

[6] Rear Admiral David W. Titley, U.S. Navy, and Courtney C. St. John, "Arctic Security Considerations and the U.S. Navy's Roadmap for the Arctic," *Naval War College Review* 63 no. 2 (Spring 2010): 35.

in 1979 to obtain comprehensive ice coverage measurements. This research indicated that the Arctic sea ice coverage extent reached a record low in September 2007.[7]

Importance of the Arctic

The changing Arctic environment is important due to the potential for economic gain, improved energy security, increased human activity and national security. An ice-free Arctic offers significant economic benefits in the form of marine transportation savings and natural resources. Global shipping routes through an ice-free Arctic are shorter than historic routes and will provide substantial savings to commercial shipping companies in the form of reduced transportation costs. The Northwest Passage through the Canadian Arctic Archipelago is 4,860 nautical miles shorter than the route between Europe and Asia via the Panama Canal.[8] A transit from Korea to the Netherlands using the Northern Sea Route along the coast of Russia is 3,500 miles and 10 days shorter through the Arctic than through the Suez Canal.[9]

The economic value of the Arctic region in terms of natural resources is equally important. The U.S. Geological Survey indicated the extensive Arctic continental shelves may constitute the world's largest unexplored prospective area for petroleum in 2008.[10] The Arctic contains significant deposits of chromium, cobalt, copper, gold and magnesium among

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[7] National Snow and Ice Data Center, "Arctic Sea Ice News & Analysis," http://nsidc.org/news/press/2007_seaiceminimum/20071001_pressrelease.html/ (accessed 12 March 2012).

[8] U.K. Parliament, House of Commons, *Protecting the Arctic: Written Evidence*, Environmental Audit Committee, March 2012, 87.

[9] Heather Conley and Jamie Kraut. *U.S. Strategic Interests in the Arctic An Assessment of Current Challenges and New Opportunities for Cooperation.* A Report of the CSIS Europe Program. Washington, DC: Center for Strategic and International Studies, April 2010, 6.

[10] Kenneth J. Bird et al., *Circum-Arctic Resource Appraisal; Estimates of Undiscovered Oil and Gas North of the Arctic Circle: U.S. Geological Survey Fact Sheet 2008-3049*, http://pubs.usgs.gov/fs/2008/3049/ (accessed 25 March 2012), 1.

other precious metals. Arctic fishing grounds are some of the most plentiful on the planet, with 10 percent of the world's white fish catch coming from the Arctic Ocean.[11]

Finally, the changing Arctic can affect U.S. standing on the international stage through opportunities to engage and cooperate with Arctic nations but also through competition. The Arctic Council, consisting of Canada, Denmark, Finland, Iceland, Norway, Sweden, the Russian Federation and the U.S., is an intergovernmental forum to promote cooperation among the Arctic nations and resolve issues regarding the Arctic.[12] This council presents an opportunity to improve relations with other nations within the council while addressing the changing Arctic. Historical competitors of the United States are also preparing for an ice-free Arctic. Arthur Chilingarov, special presidential aide to Russian president Dmitry Medvedev on Arctic and Antarctic Affairs, indicated in March of 2010 "the [Russian] government is devoting [to] the Arctic enormous significance."[13] Russia is moving forward with ambitious oil exploration in many parts of the Arctic Ocean. Without prompt action, the U.S. could fall behind its global competitors in preparing for an ice-free Arctic in areas such as natural resource harvesting.

Highlights of U.S. Preparations

Efforts by the United States to prepare for an ice-free Arctic have included dissemination of policy guidance, coordination of international agreements, and definition of required mission areas and identification of capability gaps. Much of this has been and

[11] Heather Conley and Jamie Kraut, *U.S. Strategic Interests in the Arctic An Assessment of Current Challenges and New Opportunities for Cooperation,* 4-5.

[12] About the Arctic Council, Arctic Council, last modified April 7, 2011, http://www.arctic-council.org/index.php/en/about-us

[13] Norwegian Barents Secretariat, "Moscow Airport Vnukono to Become Arctic Logistics Base," http://www.barentsobserver.com/moscow-airport-vnukovo-to-become-arctic-logistics-base.4761334-116320.html/ (accessed 23 March 2012).

continues to be achieved through collaborative study, exercises and war gaming. Policy stated by the U.S. government regarding the Arctic has exhibited a logical progression. The progress began with broad strategic guidance from the Office of the President of the United States and continued to tangible international agreements and exercises at the operational and tactical level.

President George W. Bush formalized U.S. national policy and strategic guidance regarding the Arctic in 2009 through the combined National Security Presidential Directive 66 and Homeland Security Presidential Directive 25 (NSPD-66/HSPD-25). The President and the DOD emphasized the Arctic in the 2010 National Security Strategy and the 2010 Quadrennial Defense Review. The 2011 Unified Command Plan designated the U.S. Northern Command (NORTHCOM) as the lead Combatant Commander responsible to advocate for Arctic capabilities.[14] In May 2011, the DOD provided an update to congress of departmental preparations for Arctic operations. This report provided the DOD strategic objectives as applied to the Arctic. Also, the Chief of Naval Operations directed the Oceanographer of the Navy to establish and begin leading Task Force Climate Change (TFCC) in 2009.[15] The first action of TFCC was delivery of the Navy Arctic Roadmap in November of that same year, which provided a framework for future Navy action with respect to the Arctic including a list of objectives through FY14.[16] The Chief of Naval Operations formally identified its strategic objectives in the Arctic in May of 2010.

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[14] Unified Command Plan, U.S. Department of Defense, Last modified October, 28 2011, http://www.defense.gov/ucc/.

[15] U.S. Department of the Navy, Office of the Vice Chief of Naval Operations, *Task Force Climate Change*, Washington, DC: Department of Navy, October 2009.

[16] U.S. Department of the Navy, Office of the Vice Chief of Naval Operations, *Navy Arctic Roadmap*, Washington, DC: Department of Navy, November 2009.

Strategic guidance has been supplemented by a sustained effort to identify the mission areas that the DOD and United States Coast Guard (USCG) will be responsible for in the Arctic. For example, the DOD through NORTHCOM and DHS through the USCG established the Arctic Capabilities Assessment Working Group (CAWG) that first met in March of 2012 to refine mission areas and identify capability gaps in the Arctic between the DOD and DHS. This study identified four primary mission areas in the Arctic as communications, maritime domain awareness, infrastructure and presence. Though not explicitly stated in this study, the missions of search and rescue and environmental response could be considered part of presence.[17]

Finally, the DOD and DHS have prepared for an ice-free Arctic through periodic exercises and war gaming. Northern Edge is the largest annual military joint training exercise in and around Alaska, providing military forces the opportunity to operate together in the harsh, cold weather environment. Northern Edge 2011 included over 6,000 participants from all the services.[18] In the summer of 2012 the USCG will launch Arctic Shield, its largest deployment to the Arctic ever to monitor activities as Royal Dutch Shell prepares to drill exploratory oil wells in the Chukchi and Beaufort seas.[19] The international community has held Arctic war games in London in 2009 and at the Naval War College in December of 2010 and September of 2011, each with a different focus, in an attempt to answer questions regarding operations in an ice-free Arctic. The lessons learned from

[17] U.S. Department of Defense and Department of Homeland Security, *Arctic Capabilities Assessment Working Group White Paper,* 4.

[18] Northern Edge Alaska's Premier Joint Training Exercise, Joint Base Elmendorf–Richardson, http://www.jber.af.mil/alcom/northernedge/northernedge2011.asp/ (accessed 1 April 2012).

[19] Los Angeles Times. "Coast Guard Beefs Up Deployment in the Arctic." http://www.latimes.com/news/nation/nationnow/ la-na-nn-coast-guard-arctic-20120301,0,3177903.story/ (accessed 1 April 2012).

exercises and war games have supplemented strategic guidance and studies to provide a more comprehensive approach to preparations for the Arctic.

Up to this point this paper has provided background on the problem of ice melt in the Arctic, why an ice-free Arctic is important, and provided some insight into what actions the U.S. government has taken to prepare for an ice-free Arctic environment. The next step is to outline a framework of how to prepare for an ice-free Arctic using the maxims of operational art that can supplement those measures already taken by the U.S. government.

An Operational Art Approach

The U.S. military has developed the tenets of operational art with some intended generality so that the methodology it entails can be applied to any operation in any part of the globe. To date, preparations for Arctic operations by the U.S. military have followed a three tiered approach which has not included tenets of operational art. The top tier consists of strategic guidance that has been promulgated, and the middle tier identifies necessary missions and capability gaps in the Arctic. The bottom tier consists of obtaining useful lessons learned from exercises and war gaming. One could roughly equate this tiered method to a strategic, operational and tactical approach but only loosely. This three tiered approach has, and will continue to, yield valuable information for operations in an ice-free Arctic. However, many of the exercises gravitate towards the tactical level and the overall approach exhibits a gap at the operational level.

A more mature approach to prepare of operations in the Arctic would begin with strategic policy that outlines associated strategic objectives, supported by clearly identified theater strategic objectives, followed by operational and tactical objectives with the level of detail that is sufficient for the military and agencies of the government to take action. An

analysis that employs the tenets of operational art is of value to determine the sustainment requirements for operations in an ice-free Arctic.

The first step in this analysis is a review of the operational objectives. Formalized operational objectives would assist all parties concerned in preparations for an ice-free Arctic. The U.S. military has not promulgated operational level objectives for ice-free operations in the Arctic. In September of 2011 NORTHCOM provided a Commander's Arctic Estimate which may have provided such objectives, however, this assessment is classified. Based upon the strategic guidance laid out in the President's NSPD-66/HSPD-25, and strategic objectives stated in the DOD report to Congress and the U.S. Navy Arctic strategic objectives, and absent operational objectives from the lead Combatant Commander, it can be inferred that the operational level objectives for the Arctic are:

- Ensure security in the Arctic region through military presence and robust maritime domain awareness with a focus on U.S. soil and waters off the U.S. coast.
- Ensure protection and safety of Americans in the Arctic through military presence and diverse mission capability with emphasis on search and rescue.
- Ensure protection of the natural environment to include an oil spill response capability commensurate with the scope of oil drilling in the Arctic.

To best determine the sustainment requirements for ice-free operations in the Arctic, the U.S. military will need to conduct an analysis that addresses the operational objectives as they relate to the operational factors of time, space, and force. This analysis will need to be combined with candid prioritization that accounts for constrained budgets.

Operational Factor of Time

Analysis of the factor of time was introduced in the counter-argument section of this paper. As activities expand into the distant in the Arctic, such as expansion of oil and gas drilling and commercial shipping, the responsibilities of the military will expand. The sustainment requirements to support these operations will expand proportionately. However, the near term goal is to have a capacity in place by approximately the year 2030, when an ice-free Arctic is anticipated. Two decades into the future is not long considering the extended timelines common in government procurement or DOD acquisitions. Delaying capital investment in infrastructure cannot be delayed if the U.S. government is to have a robust capability for operating in the Arctic by the year 2030. This time frame requires determination of sustainment needs now to meet a potentially ice-free Arctic in two decades. With an analysis of time complete, an assessment of the factor of space, followed by a similar analysis of the factor of force will provide insight into the types and size of units necessary to operate in the Arctic. This information regarding force can then be used to determine infrastructure needs in the Arctic to support those forces.

Operational Factor of Space

The pertinent geographic region of the Arctic that the U.S. should focus on is that area that covers the greatest anticipated level of activity and responsibility in the Arctic. This approach will best prioritize resources and can be achieved by identifying the geographic areas where mission demands will be the greatest. Focusing on the geostrategic area surrounding Alaska is the logical priority. An initial area of operations to focus on is the U.S. area of responsibility outlined in the International Arctic Search and Rescue Agreement

signed in May of 2011, shown in Figure 1.[20] The SAR area of responsibility encompasses the second geographic region of importance which is the area of anticipated oil and gas drilling over the coming decades in the Beaufort and Chukchi Sea off the coast of Alaska shown in Figure 2.[21]

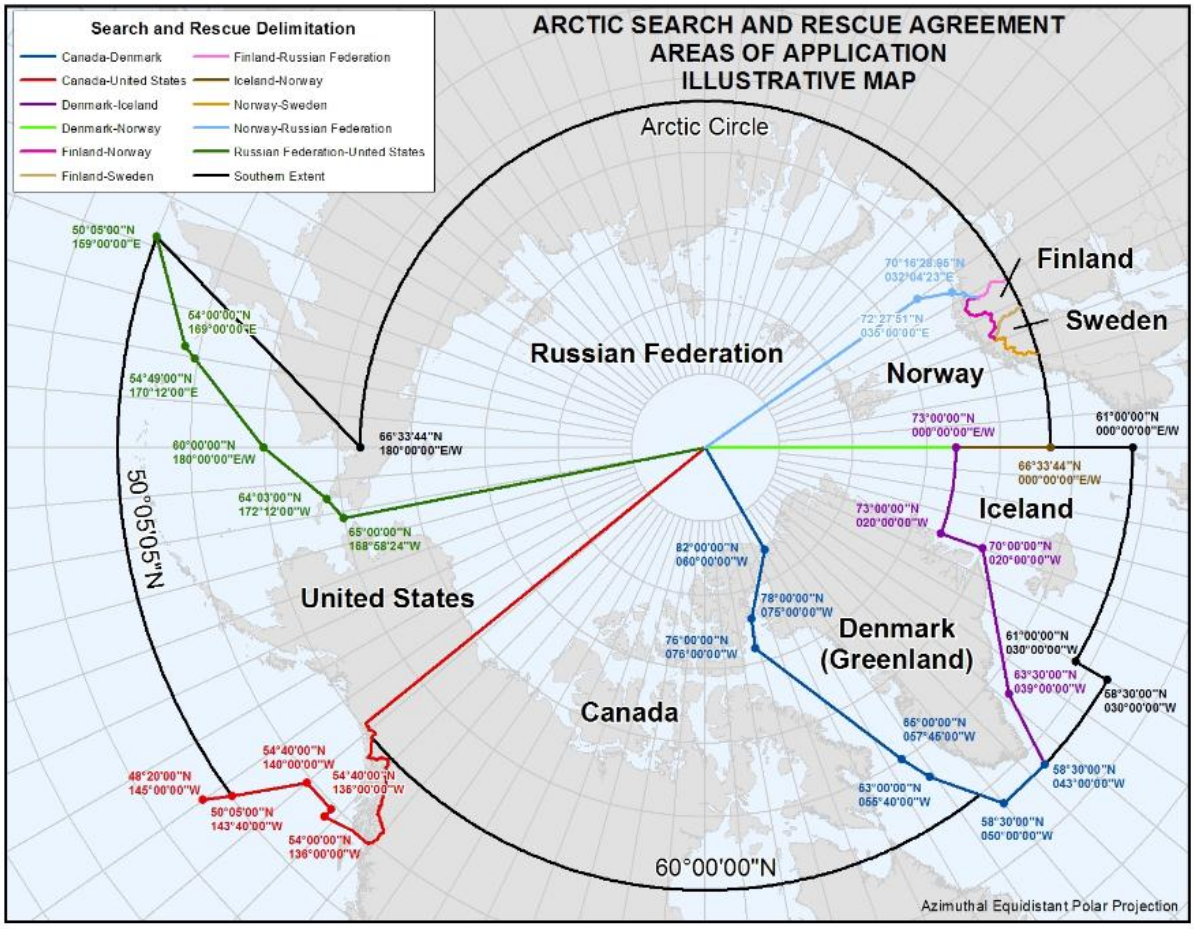

Figure 1
Map denoting SAR areas of responsibilities as determined by the International Arctic SAR Agreement. Source: "Arctic Search and Rescue Agreement," accessed 7 April 2012 at http://www.arcticportal.org/features/ features-of-2011/arctic-search-and-rescue-agreement.

[20] Arctic Council, *Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic*, 23 May 2011, http://www.arcticportal.org/features/%20features-of-2011/arctic-search-and-rescue-agreement/, (accessed 7 April 2012).

[21] Leslie Holland-Bartels and Brenda Pierce eds., 2011, *An Evaluation of the Science Needs to Inform Decisions on Outer Continental Shelf Energy Development in the Chukchi and Beaufort Seas*, Alaska: U.S. Geological Survey Circular 1370, 1.

Thirdly, consider the portions of the two dominant commercial shipping routes through an ice-free Arctic that pass near or through U.S. waters. The western portion of the Northwest Passage passes through the U.S. exclusive economic zone in the Beaufort Sea, Chukchi Sea, and Bering Strait into the Bering Sea. The eastern terminus of the Northern Sea Route similarly passes through the Chukchi Sea, Bering Strait into the Bering Sea.

The determination of the geographic area in the Arctic surrounding Alaska that includes the SAR area of responsibility, the region of anticipated oil and gas drilling and the majority of commercial shipping defines the area of responsibility for the U.S. military in Arctic. Focusing on the region that encompasses these three areas of activity will efficiently prioritize the force allocation of the U.S government in the Arctic. Finally, after considering the factors of time and space the analysis is well posed to consider the factor force.

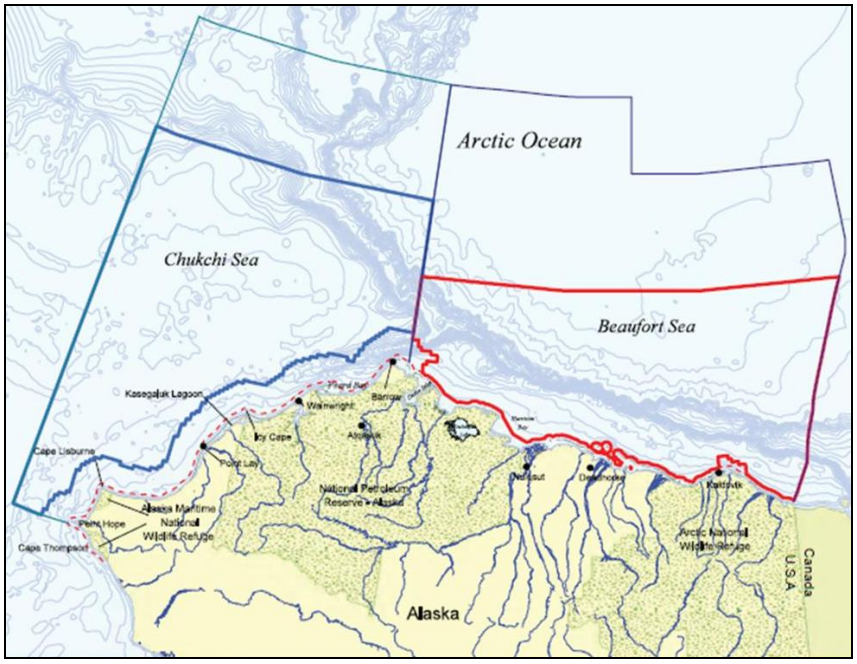

Figure 2
Map of the north slope of Alaska showing major oil and gas leasing areas. The area in the lower left shows the Chukchi Sea sale area and the area in the lower right shows the main Beaufort Sea sale area. Source: "An Evaluation of the Science Needs to Inform Decisions on Outer Continental Shelf Energy Development in the Chukchi and Beaufort Seas" U.S. Geological Survey Circular 1370.

Operational Factor of Force

The necessary force requirements can be determined by asking the question; what size and composition of force is necessary to perform the anticipated missions in the space previously outlined by about the year 2030? The previously mentioned mission areas of communications, maritime domain awareness, infrastructure and presence scope this question. Long range aviation assets will be based along the northern coast to provide coverage to the North Pole in accordance with the International Arctic SAR Agreement. Robust coverage and presence must be supplemented by mobile assets with longer term self-sustainable capability and some short range aviation capability. This capability can be met by an icebreaker with an embarked helicopter detachment. The U.S. currently has only one operational ice breaker in its inventory.[22] Oil spill response will be performed by a combination of aircraft and specialized surface vessels that are appropriately equipped and ice resistant.

Despite focusing the area of operations for U.S. forces to a finite region, as discussed in the factor space section, the area that U.S. forces are responsible for remains vast. An operations research analysis would be necessary to quantify the amount of forces required but is beyond the scope of this paper. However, an illustrative example of such an analysis for SAR would consider anticipated average vessel traffic along shipping routes and operational oil and gas drilling platforms per unit area versus historical numbers and types of incidents that require SAR action. The force size and density would be low but grow as oil and gas operations expanded. The USCG will be performing something similar to this in summer of 2012 during operation Arctic Shield.

[22] ABS Consulting, *United States Coast Guard High Latitude Region Mission Analysis Capstone Summary*, Report Prepared for the United States Coast Guard. Arlington, VA. July 2010, 10.

Sustainment

Finally, analysis of the operational factors of time, space and force, while considering the operational objectives the general composition of forces is outlined to determine sustainment requirements. This analysis concludes with the question; what are the sustainment requirements for the force size and composition identified by an analysis of time, space and force required to perform the anticipated missions in the geographic region of the Arctic previously outlined by about the year 2030?

Mobile assets that are moderately self-sustaining such as ice resistant surface vessels are of particular value in the Arctic. However, their on-station time, range and coverage capabilities are specific and finite. Adequate sustainment requirements to support these types of vessels will be necessary. Underway replenishment of U.S. Navy vessels will be of limited use due to prohibitive winds and seas limits in the extreme Arctic environment. As a result, shoreside pier resupply facilities will most likely be required for these vessels. Major support and repair facilities will be restricted to existing facilities in the continental United States. Additionally, shoreside infrastructure will be necessary for SAR and oil spill response equipment including port facilities, air strips and weather resistant shelters for SAR aircraft and crews. Resupply distribution will most likely be conducted via air and sea and require many of the same resources including ice resistant surface vessels, aircraft, landing strips and support facilities.

After assessing sustainment requirements, a first step in meeting those requirements is to identify and leverage the modest existing facilities in Alaska. Towns along the coast of Alaska including Prudhoe Bay, Barrow and Nome are roughly evenly distributed along the

Alaskan coast and have some existing facilities. Expansion of these locations is a reasonable first step in consideration for logistical basing.

CONCLUSIONS

The DOD and DHS through the USCG will most likely shoulder a greater share of the burden in the Arctic on behalf of the U.S. government. However, considering the preponderance of resources within the DOD, and to a lesser extent the USCG, the military will play a disproportionately larger role in our nation's preparations for an Arctic environment that will be ice-free. The Navy and USCG will play a greater role in the U.S. military's role in the Arctic particularly because the Arctic domain is predominantly a maritime environment.

Budgets to fund military preparedness will be constrained by budget pressures over the next couple decades and preparations for operations in the Arctic will be no exception. Identifying and formalizing the requirements to meet national objectives on a global basis is prudent. However, these must be tempered by fiscal realities through forthright prioritization and risk assessment. In the case of the Arctic focusing on the geostrategic area surrounding Alaska first, as discussed in this paper, is prudent.

The three tiered approach to preparing for an ice-free Arctic that the U.S. military has employed to date has consisted of promulgating strategic guidance, identification of missions and capability gaps and finally gleaning lessons learned from exercises and war gaming. This approach has yielded dividends and helped identify sustainment needs and shortfalls that the U.S. military faces in the Arctic. However, by applying the tenets of operational art the U.S. military can improve upon its assessment of logistical requirements in the Arctic. Applying operational art is achieved by considering the factors of time, space and force

against operational objectives in the theater and the operational function of sustainment. Such an assessment will help better prioritize limited resources and expenditures, which is timely, and a necessary reality considering the austere fiscal environment that the DOD and DHS will face for the foreseeable future.

RECOMMENDATIONS

Recommendation #1: NORTHCOM state their unclassified operational objectives for ice-free operations in the Arctic. The strategic policy guidance and objectives provided by the President, Department of Defense and U.S. Navy are of significant value. However, objectives at the operational level provided by the lead Combatant Commander responsible for the Arctic are necessary to aid preparations for operating in an ice-free Arctic. Subordinate commanders can better focus their efforts towards preparing for an ice-free Arctic environment if they are provided commander's guidance that include the commander's operational level objectives.

Recommendation #2: To date, the U.S. military has employed a three tiered approach in its preparations for an ice-free Arctic environment. This approach has not included tenets of operational art. Recommend that the U.S. military supplement its three tiered approach to preparing for an ice-free Arctic with a method that applies the tenets of operational art, specifically the factors of time, space and force against operational objectives as they apply to the function of sustainment. By supplementing the three tiered approach with an analysis using operational art, the U.S. military can improve upon its assessment of sustainment requirements in the Arctic than had it used the three tiered approach only.

Recommendation #3: Consider partnerships between government and private industry that leverage shared goals. One area that presents a partnership opportunity is in the area of oil

and gas development. Increased mission demands on the U.S military in an ice-free Arctic, particularly the USCG, will be a direct result of increased human activity surrounding expanded oil and gas exploration. Oil and gas exploration and drilling operations require a significant logistical footprint. Solutions to common sustainment needs may be shared between government and private entities. For example, airfields that include equipment shelters and storage facilities for both USCG aircraft and oil platform supply helicopters can be shared.

Consider partnership arrangements where private oil and gas companies assume greater responsibility for oil spill response capabilities that will be proportional to profits these companies stand to yield from oil and gas drilling in the Arctic over the coming decades. The scope of requirements to safely monitor the entire Arctic is vast. Expanding oil and gas exploration will require equally vast resources to safely monitor this process and respond to oil spills.

The current capacity that the U.S. has for oil spill response is insufficient. This includes collective capacity between government and private industry combined. The 2010 Deepwater Horizon spill demonstrated the inability of the U.S. government and the oil and gas industry to effectively contain a spill resulting from a large oil platform accident in the Gulf of Mexico. This disaster occurred in the Gulf of Mexico which is a more benign environment than the Arctic and on the doorstep of the bulk of the nations' oil industry resources. Vast oil spill response capabilities are required to ensure that oil and gas harvesting can be conducted safely while the environment is protected. Considering the austere budget environment that DHS, as well as all parts of the U.S. government face, it is unlikely the necessary resources to conduct operations in the Arctic, to include oil spill

response will be sufficiently funded. An appropriately crafted partnership between government and private industry can achieve an arrangement where private industry stands to gain financially and the public benefits from increased oil and gas harvesting but not with undue risk to the environment.

FINAL REMARKS

The U.S. military has employed a three tiered approach to preparing for operations in an ice-free Arctic. This approach has consisted of first; promulgating strategic guidance, followed by identification of missions and capability gaps and a final step of gleaning lessons learned from periodic exercises and war games. This approach has yielded benefits but is deficient at the operational level. As a result, it has not sufficiently articulated the sustainment requirements necessary to best address operations in an ice-free Arctic environment.

This paper has demonstrated that supplementing this three tiered approach with an analysis that applies the tenets of operational art adds value to the U.S. military's preparations for an ice-free Arctic. By employing a method that leverages the tenets of operational art as well as the three tiered approach the U.S. military can improve upon its assessment of sustainment requirements in the Arctic that if it uses the three tiered approach only. Specifically, by performing an analysis of the operational factors of time, space and force with regard to the missions in the Arctic as it applies to the operational function of logistics the U.S. military can improve upon its assessment of sustainment requirements in the Arctic for the coming decades. This approach will assist in prioritizing resource expenditures in what will undoubtedly be a constrained budget environment. Finally,

although this paper focused on the logistical requirements in the Arctic the methodology can be applied to address other mission areas in the Arctic such as communications.

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